

The complement system

- A defensive system consisting of over 30 proteins produced by the liver and found in circulating blood serum.
- The main proteins are 11 in number, C1- 9, B and D
- Complement kills microbes in three different ways
 - 1. Opsonization
 - 2. Inflammation
 - 3. Cytolysis





The Complement system [Compatibility Model] - PowerPoint

ANIMATIONS SLIDESHOW FULLVIEW VIEW

A Cascade System

- The complement works as a cascade system.
 - Cascade is when one reaction triggers another reaction which trigger others and so on.
 - These types of systems can grow exponentially very fast.

NOTES COMMENTS

 1st Year



You



Maha


1st

 
111 others

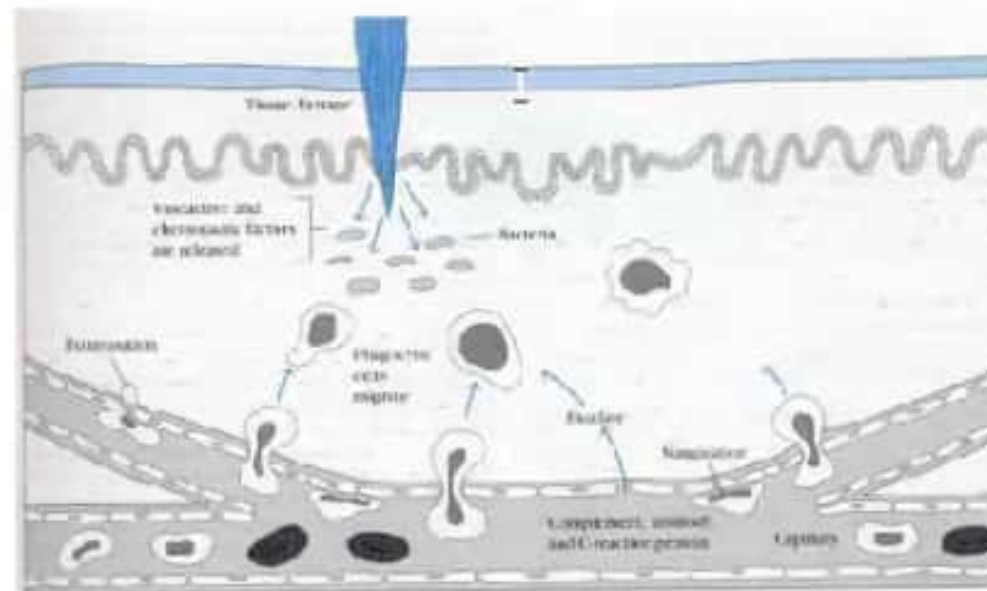
Cascade activation

- Complement proteins are often designated by an uppercase letter C and are inactive until they are split into products.
 - Example: C1 → C1a and C1b
- When the products are split they become active. The active products are usually designated with a lower case a or b.
 - Example: C1a and C1b

The screenshot shows a mobile application interface for a '1st Year' group. At the top, there is a navigation bar with icons for NOTES, COMMENTS, and other functions. Below the navigation bar, the text '1st Year' is displayed next to a circular icon containing a crossed-out 'S'. The main content area features four large, rounded rectangular buttons arranged horizontally. The first button is pink with a white 'S' and a crossed-out 'S' icon, labeled 'You'. The second button is dark grey with a circular profile picture of a person and a crossed-out 'S' icon, labeled 'Maha'. The third button is blue with a white 'Y' and a blue icon of three vertical bars, labeled '1st'. The fourth button is purple and orange with white 'R' and 'Z' characters, labeled '112 others'.

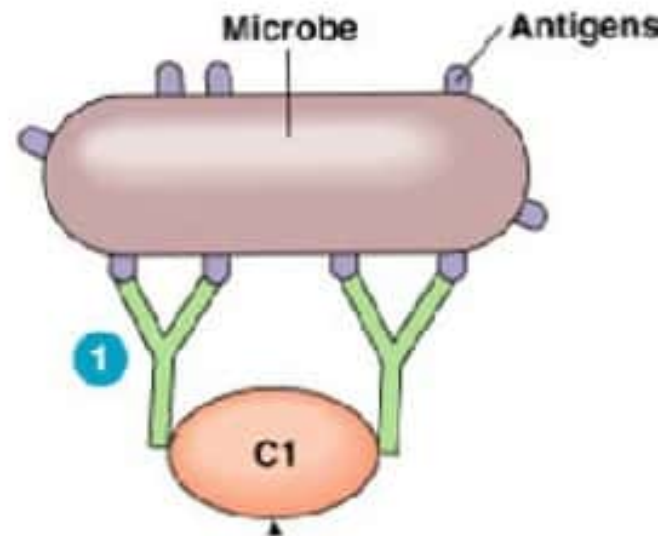
Two Pathways

- The complement pathway can be activated by either of two different pathways.
 - Classical pathway (specific immune system)
 - Alternative (non-specific immune system)



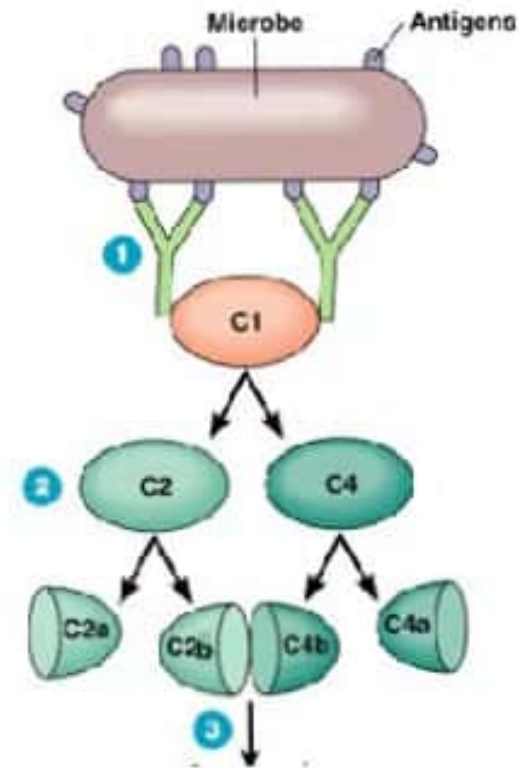
The Classical Pathway

- The classical pathway is considered to be part of the specific immune response because it relies on antibodies to initiate it.
- C1 becomes activated when it binds to the ends of antibodies



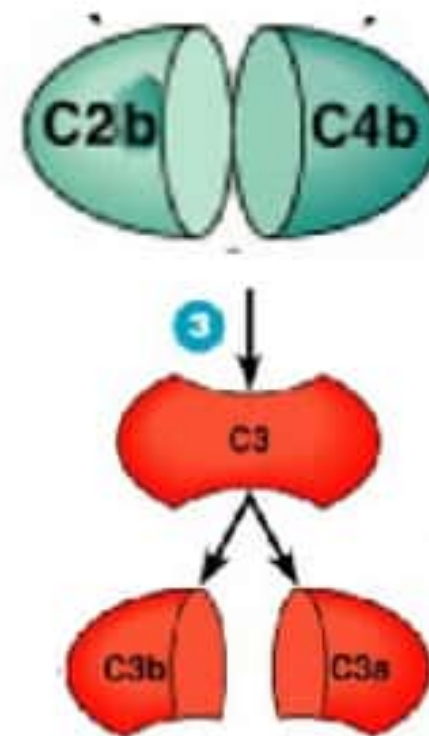
The building of a C3 activation complex

- Once C1 is activated, it activates 2 other complement proteins, C2 and C4 by cutting them in half
- C2 is cleaved into C2a and C2b
- C4 is cleaved into C4a and C4b
- Both C2b and C4b bind together on the surface of the bacteria
- C2a and C4a diffuse away



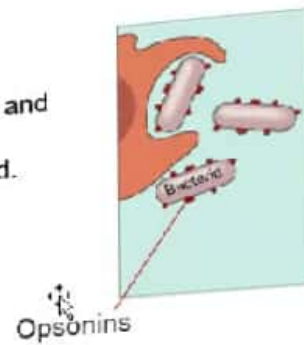
C3 Activation Complex (C3 Convertase)

- C2b and C4b bind together on the surface to form a **C3 activation complex**
- The function of the C3 activation complex is to activate C3 proteins.
 - This is done by cleaving C3 into C3a and C3b



C3b

- Many C3b molecules are produced by the C3 activation complex.
- The C3b bind to and coat the surface of the bacteria.
- C3b is an opsonin
 - Opsonins are molecules that bind both to bacteria and phagocytes
 - Opsonization increases phagocytosis by 1,000 fold.



1st Year



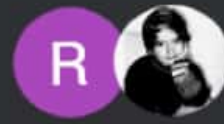
You



Fatima

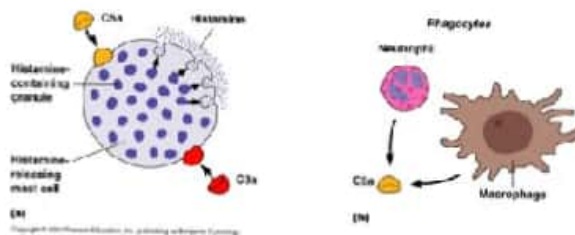


1st



116 others

C3a



C3a increases the inflammatory response by binding to mast cells and causing them to release histamine

1st Year



You



Fatima




1st



116 others

Building the C5 activation complex

- Eventually enough C3b is cleaved that the surface of the bacteria begins to become saturated with it.
- C2b and C4b which make up the C3 activation complex has a slight affinity for C3b and C3b binds to them
- When C3b binds to C2b and C4b it forms a new complex referred to as the C5 activation complex

 1st Year



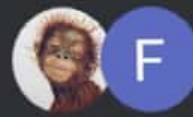
You



Razia



1st



117 others

The C5 activation complex (C5 Convertase)

- The C5 activation complex (C2b, C4b, C3b) activates C5 proteins by cleaving them into C5a and C5b
- Many C5b proteins are produced by the C5 activation complex. These C5b begin to coat the surface of the bacteria.



1st Year



You



zobia

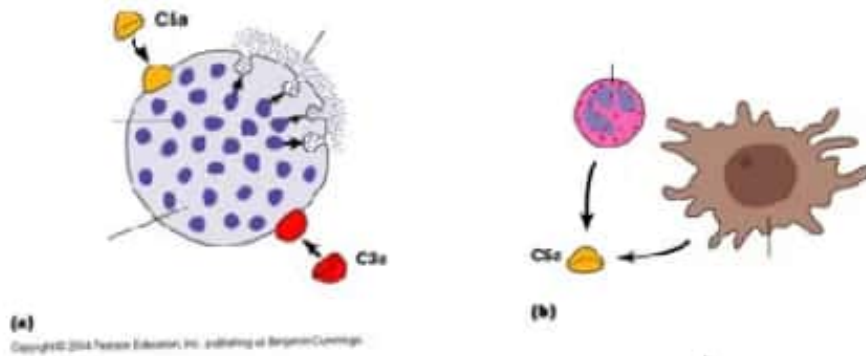


1st



116 others

The function of C5a



- C5a disperses away from the bacteria.
 - Binds to mast cells and increases inflammation.
 - Most powerful chemotactic factor known for leukocytes



1st Year



You



1st



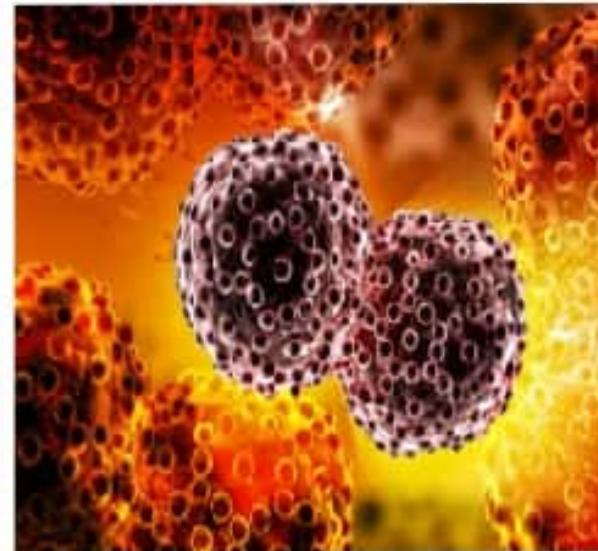
Razia



121 others

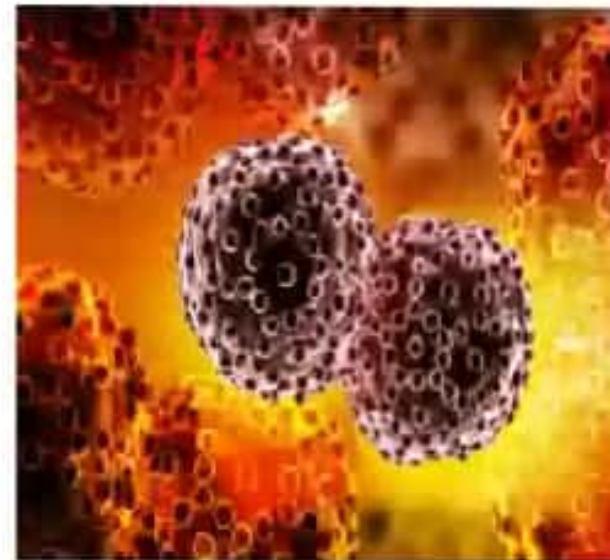
Building the Membrane Attack complex

- C5b on the surface of bacteria binds to C6
- The binding of C6 to C5b activates C6 so that it can bind to C7
- C7 binds to C8 which in turn binds to many C9's
- Together these proteins form a circular complex called the Membrane attack complex (MAC)



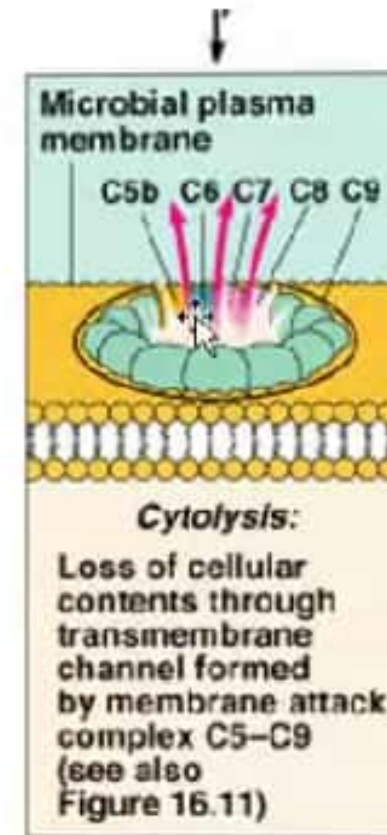
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Membrane Attack complex

- The MAC causes Cytolysis.
 - The circular membrane attack complex acts as a channel in which cytoplasm can rush out of and water rushes in.
- The cells inner integrity is compromised and it dies



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Membrane-Attack Complex

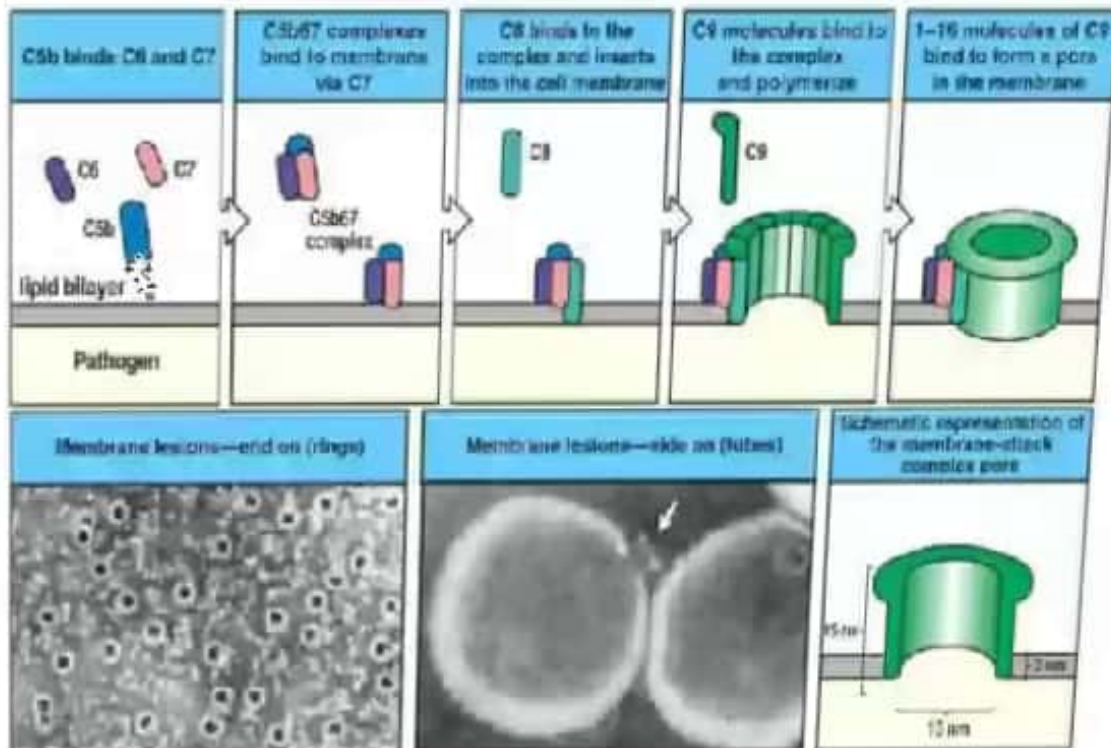


Figure 2-25 Immunobiology, 4th, © Garland Science 2005



1st Year



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Muskan



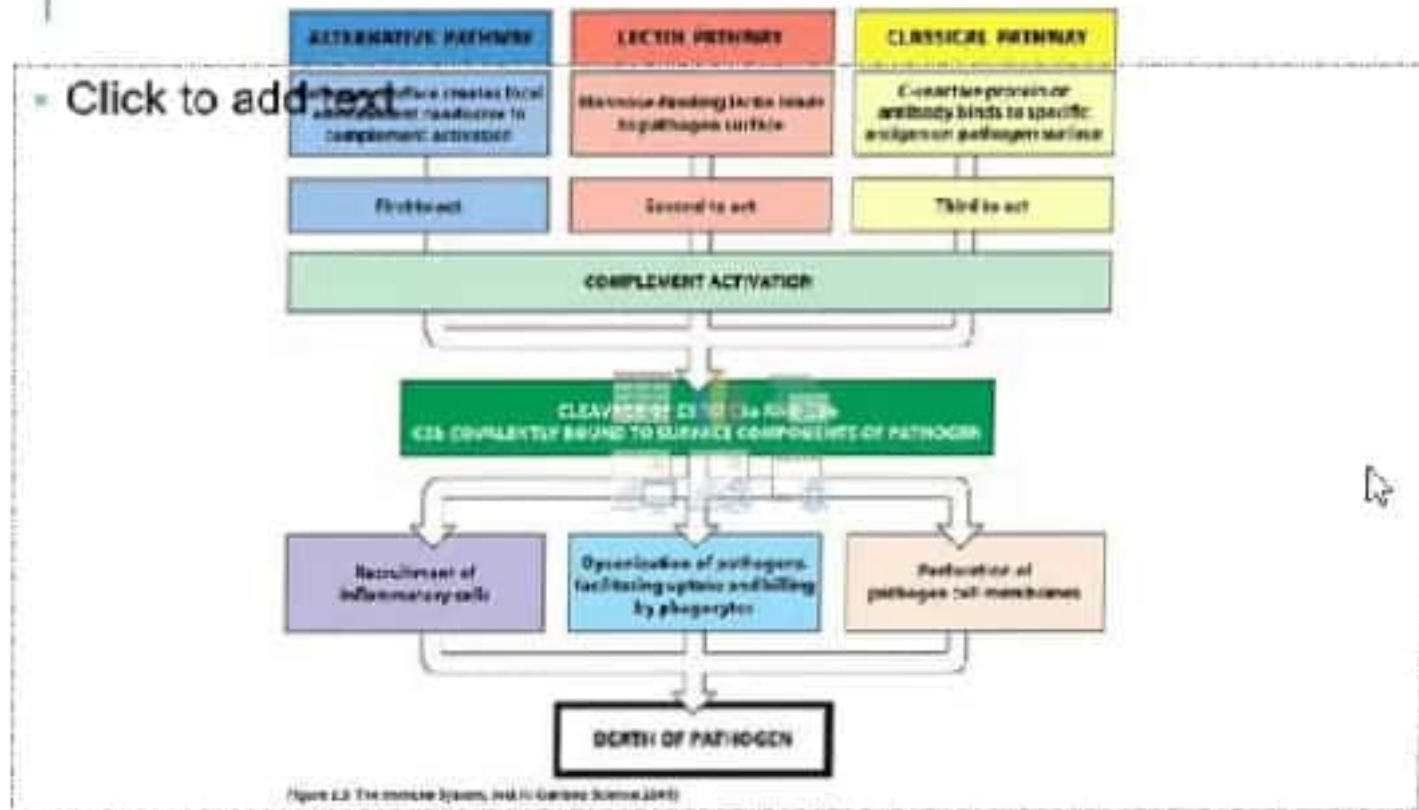
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117 others

Overview

The Complement System



The Alternative Pathway

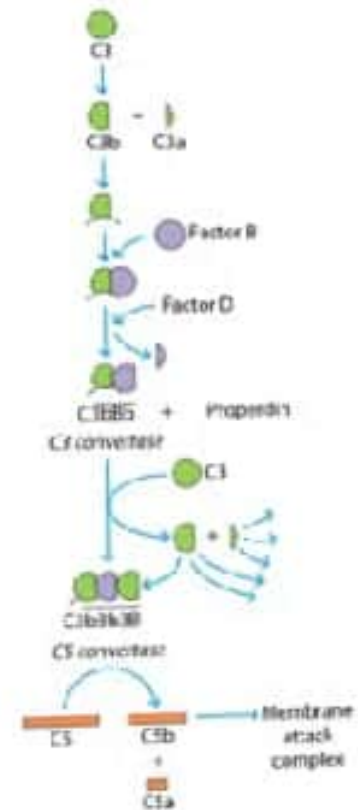
- The alternative pathway is part of the non-specific defense because it does not need antibodies to initiate the pathway.
- The alternative pathway is slower than the Classical pathway

1



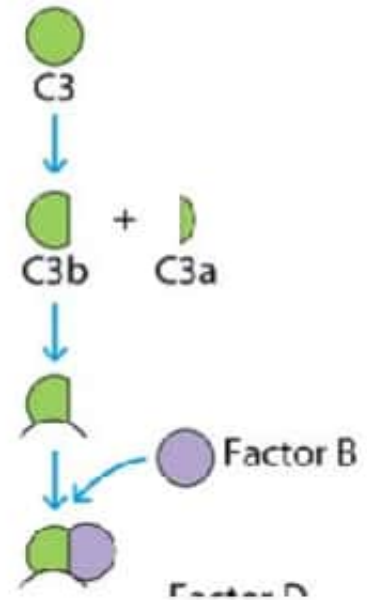
Initiation of The Alternative pathway

- C3 contains an unstable thioester bond.
- This unstable bond makes C3 subject to slow spontaneous hydrolysis to C3b and C3a
- The C3b is able to bind to foreign surface antigens.
- Mammalian cells contain sialic acid which inactivates C3b



Factor B

- C3b on the surface of a foreign cells binds to another plasma protein called factor B



S sana gul
1st year
Ok.. tnx amna

S You

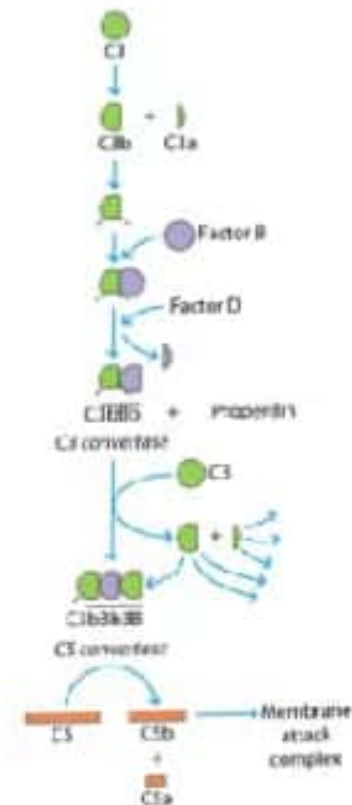
Y 1st

N Nabila

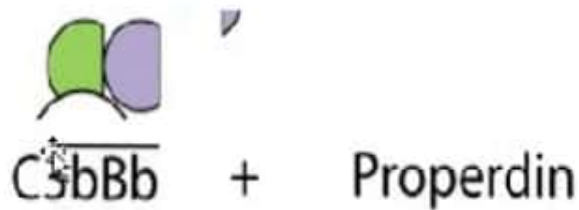
118 others

Factor D

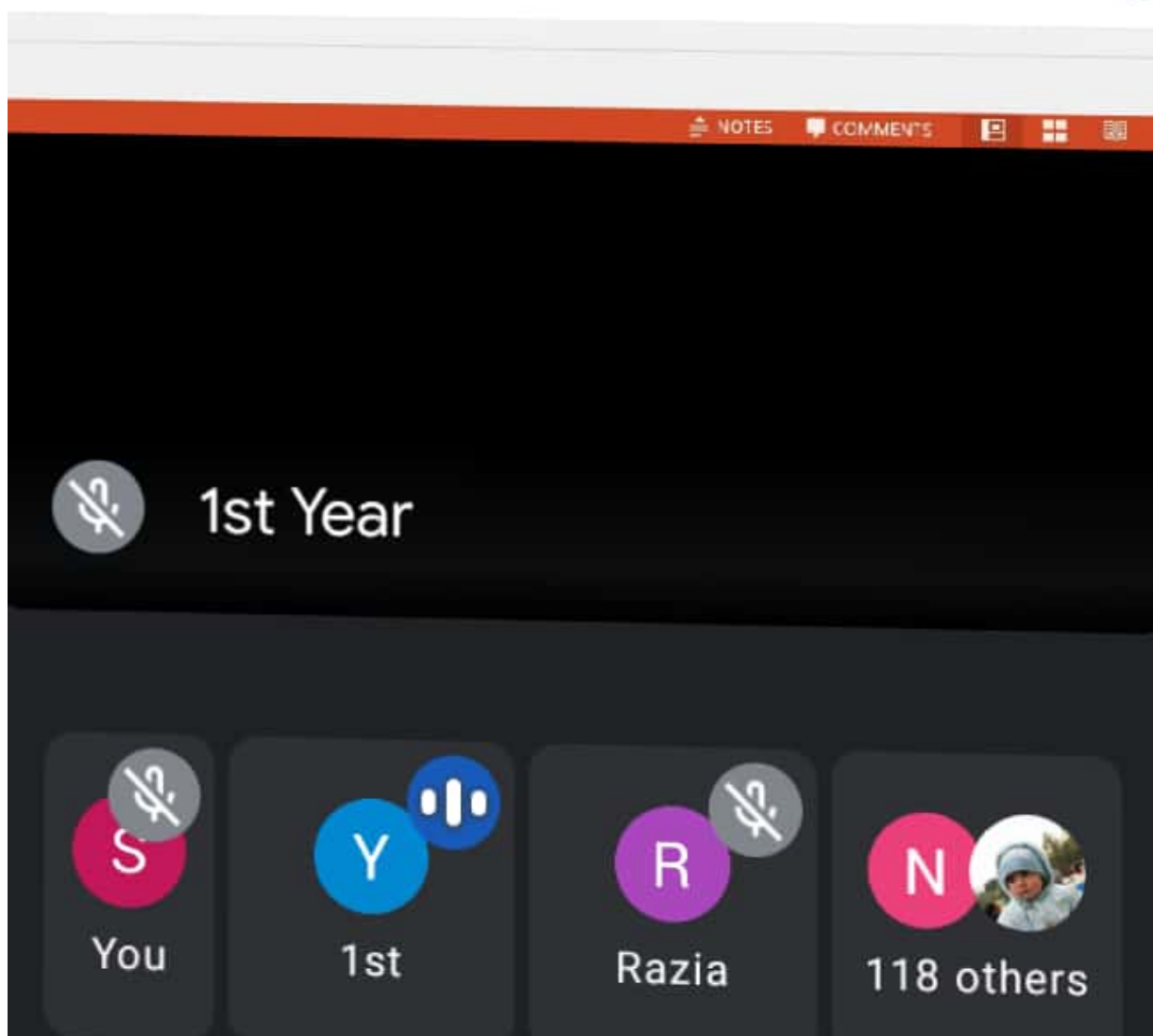
- The binding of C3b to factor B allows a protein enzyme called Factor D to cleave Factor B to Ba and Bb.
- Factor Bb remains bound to C3b while Ba and Factor D disperse away.



The C3 activation complex



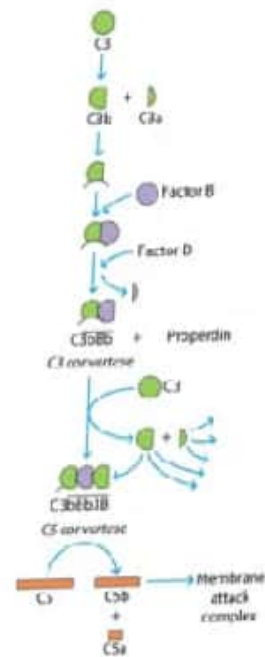
- Properdin, also called factor P, binds to the C3bBb complex to stabilize it.
- C3bBbP make up the C3 activation complex for the alternative pathway



The screenshot shows a presentation slide with a dark background. At the top, there is a navigation bar with icons for "NOTES", "COMMENTS", and other functions. Below the navigation bar, the text "1st Year" is displayed in a large, white font. At the bottom of the slide, there are four circular icons representing different users or groups: "You" (pink circle with a white 'S'), "1st" (blue circle with a white 'Y'), "Razia" (purple circle with a white 'R'), and "118 others" (pink circle with a white 'N' and a small profile picture). Each icon has a small grey circle with a white 'X' over it, indicating that the user is not currently active or has muted their microphone.

The C3 activation Complex

- The C3 activation complex causes the production of more C3b.
- This allows the initial steps of this pathway to be repeated and amplified
- 2×10^6 molecules can be generated in 5 minutes



NOTES COMMENTS

Sosan Ilham joined



You



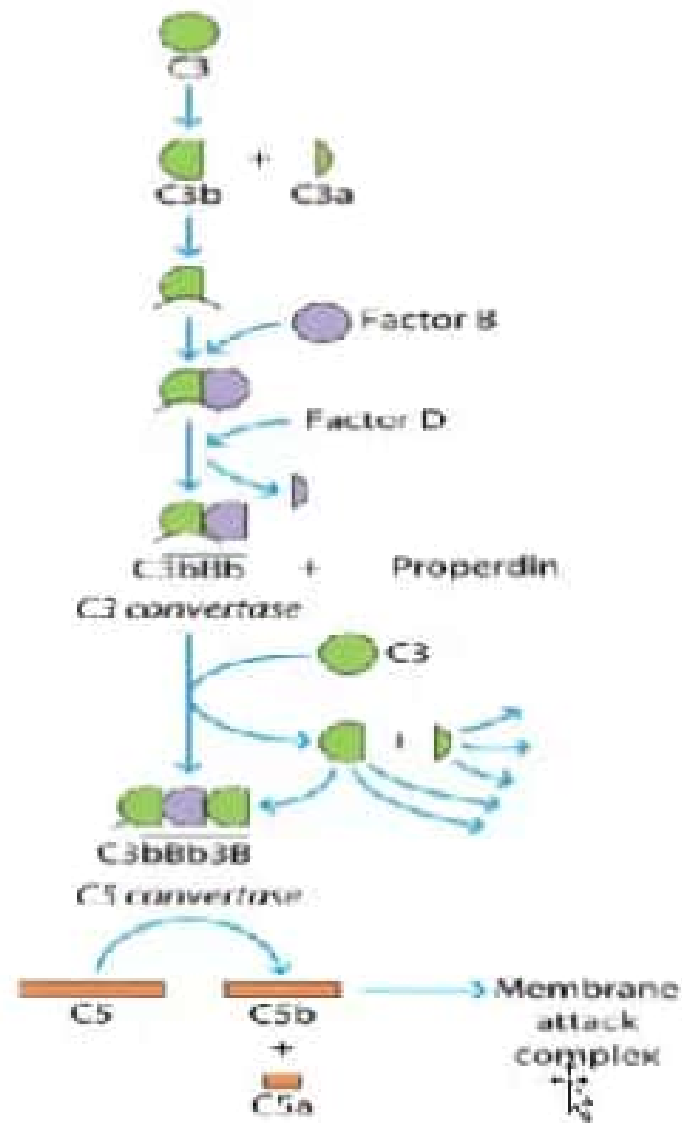
Anmol



1st



117 others



The Alternative complement pathway



Mannose-Binding Lectin Pathway

Mannose on bacterial cells stimulates MB-lectin to deposit **C3b** on pathogen which forms a **C3 Covertase**.

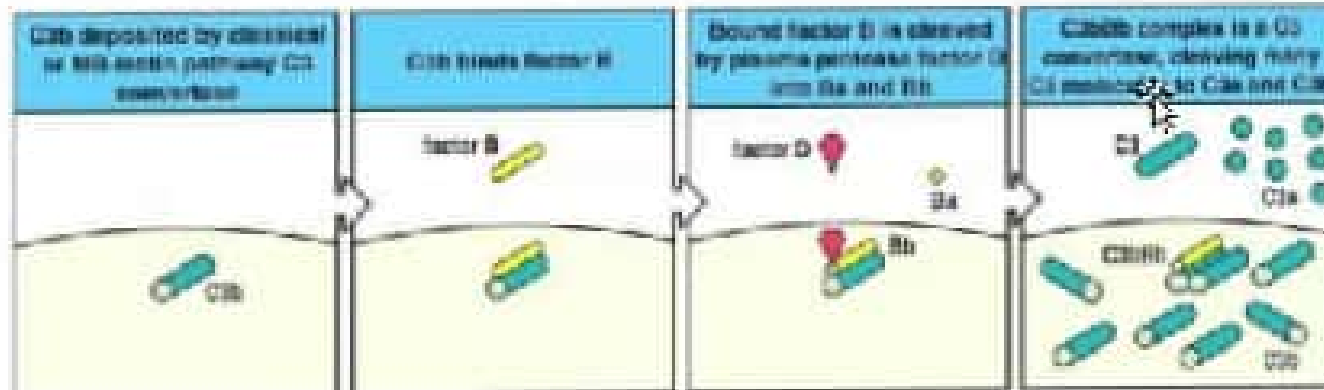
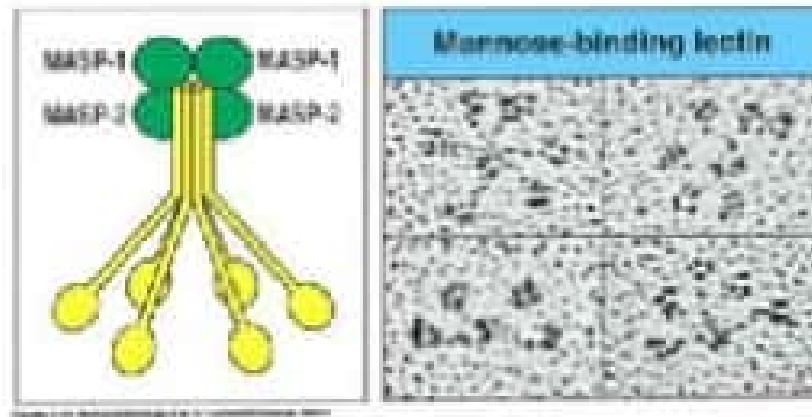
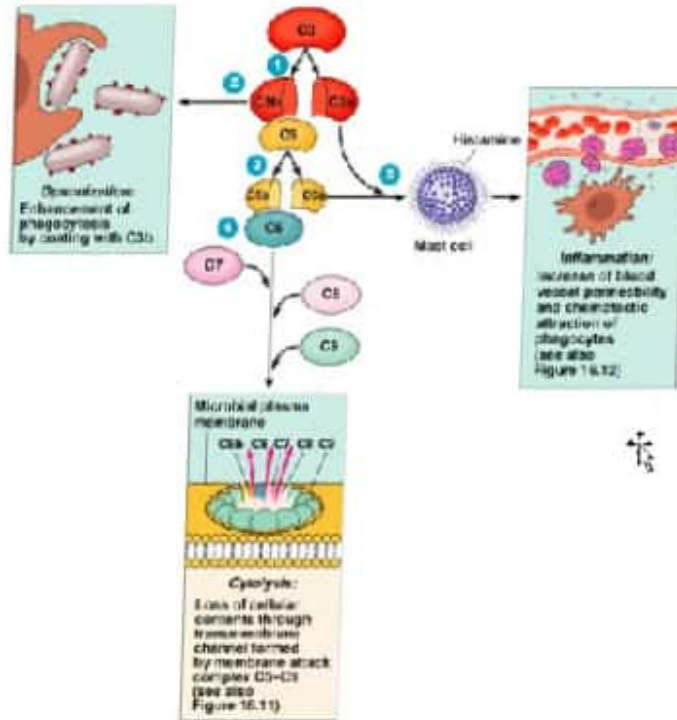


Figure 4.26 Immunobiology 6/e. © Garland Science 2005



Overview



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Faryal Bakht

Mcqs ka kch to idea hou kesy aty hn
assingmnt se to bhtr hi hn



You



Nabila

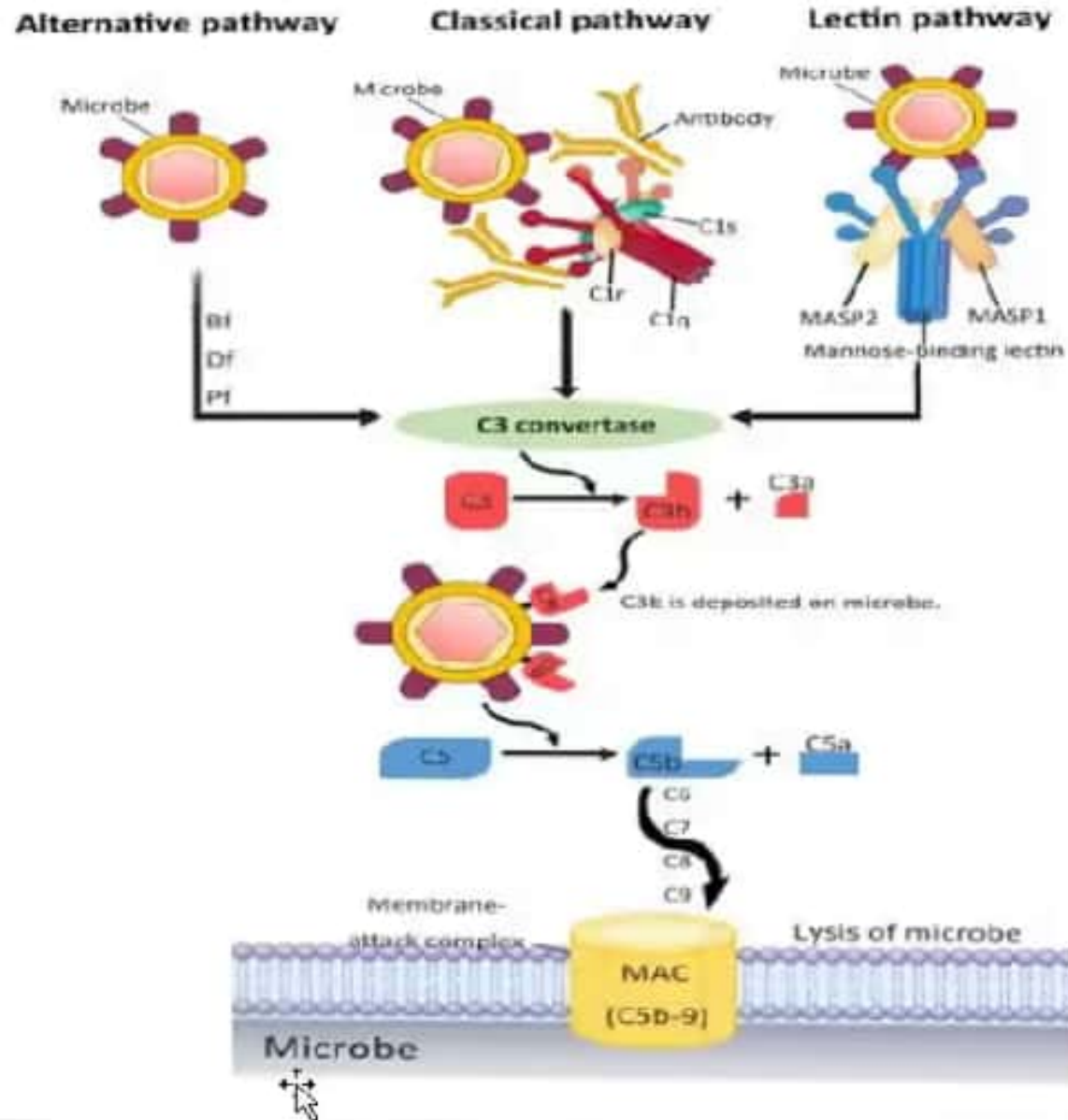


1st

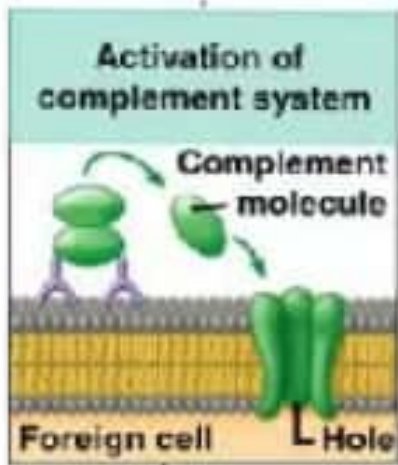


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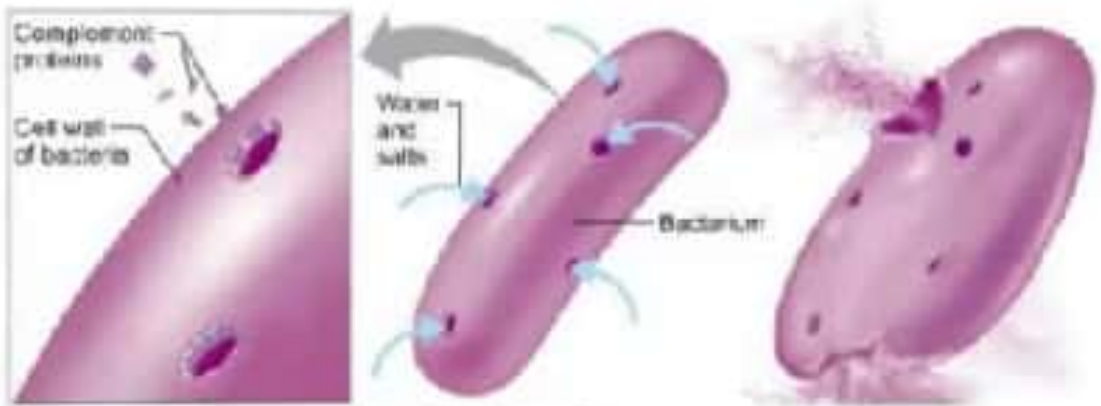




Consequences of Complement Activation



- The three complement pathways converge at the membrane-attack complex (MAC).



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Leads to

